June 21, 2000

Mr. Richard Cashwell, Reactor Director
Nuclear Reactor Laboratory
University of Wisconsin
Room 130 Mechanical Engineering Building
1513 University Avenue
Madison, WI 53706-1572

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-156/OL-00-01

Dear Mr. Cashwell:

During the week of May 22, 2000, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your University of Wisconsin reactor. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. At the conclusion of the examination, the examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will be placed in the NRC Public Document Room. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Warren Eresian at 301-415-1833 or internet e-mail wje@nrc.gov.

Sincerely,

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-156

Enclosures: 1. Initial Examination Report No. 50-156/OL-00-01
2. Examination and answer key

cc w/encls:
Please see next page

cc:

Mayor of Madison
City Hall
Madison, WI 53705

Chairman, Public Service
Commission of Wisconsin
Hill Farms State Office Building
Madison, WI 53702

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ADAMS ACCESSION #: ML003720122 **TEMPLATE #: NRR-074**

OFFICE	DIPM:IOLB		REXB:CE		REXB:BC	
NAME	EBarnhill		WEresian		LMarsh	
DATE	06/ 02 /2000		06/ 07 /2000		06/ 21 /2000	

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U. S. NUCLEAR REGULATORY COMMISSION
OPERATOR LICENSING INITIAL EXAMINATION REPORT

REPORT NO.:	50-156/OL-00-01
FACILITY DOCKET NO.:	50-156
FACILITY LICENSE NO.:	R-74
FACILITY:	University of Wisconsin
EXAMINATION DATES:	May 23-25, 2000
EXAMINER:	Warren Eresian, Chief Examiner

SUBMITTED BY: ***/RA/*** 06/ 07 /2000

Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of May 22, 2000, the NRC administered operator licensing examinations to one Senior Reactor Operator (Upgrade) candidate and four Reactor Operator Candidates. The Senior Reactor Operator (Upgrade) candidate passed the examination. All Reactor Operator candidates passed the operating test. One Reactor Operator candidate failed Category A of the written examination, one Reactor Operator candidate failed Category B of the written examination, and one Reactor Operator candidate failed Category C of the written examination.

REPORT DETAILS

1. Examiner: Warren Eresian, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**1/3**	**N/A**	**1/3**
Operating Tests	**4/0**	**1/0**	**5/0**
Overall	**1/3**	**1/0**	**2/3**

3. Exit Meeting:

Mr. Richard Cashwell, Reactor Director
Mr. Robert Agasie, Associate Reactor Director
Warren Eresian, NRC Chief Examiner

The NRC thanked the facility staff for their cooperation during the examination. The facility provided comments on the written examination. As a result of their comments, the following questions were modified or deleted:

Category A

Question 4: Accept C or D as correct answers.
Question 12: Accept A or C as correct answers.

Category B

Question 15: Delete, no correct answer.
Question 19: Accept 4,2,2,1 or 4,2,1,1 as correct answers.

Category C

Question 14: Delete, no correct answer.

U. S. NUCLEAR REGULATORY COMMISSION
NON-POWER REACTOR LICENSE EXAMINATION

FACILITY: University of Wisconsin

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 05/23/00

REGION: III

CANDIDATE:_____

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers one side ONLY. Attach any answer sheets to the examination. Points for each question are indicated in parentheses for each question. A 70% in each category is required to pass the examination.

Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20	34.4	_____	____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
19	32.8	_____	____	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
19	32.8	_____	____	C. FACILITY AND RADIATION MONITORING SYSTEMS
58	100	_____		

FINAL GRADE = _____%

All work done on this examination is my own. I have neither given nor received aid.

_____
Candidate's Signature

ENCLOSURE 2

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have not received or given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil only to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet.

6. Print your name in the upper right-hand corner of the answer sheets.

7. The point value for each question is indicated in parentheses after the question.

8. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK. NOTE: partial credit will NOT be given on multiple choice questions.

9. If the intent of a question is unclear, ask questions of the examiner only.

10. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition, turn in all scrap paper.

11. When you are done and have turned in your examination, leave the examination area as defined by the examiner. If you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION: 001 (1.00)

A reactor is subcritical with a K_{eff} of 0.955. A positive reactivity of 4.9% delta k/k is inserted into the core. At this point, the reactor is:

a. subcritical.

b. exactly critical.

c. supercritical.

d. prompt critical.

QUESTION: 002 (1.00)

Which ONE of the following isotopes is most likely to slow down neutrons quickly, i.e., produce the greatest energy loss per collision?

a. U-238.

b. Xe-135.

c. O-16.

d. H-1.

QUESTION: 003 (1.00)

A 1/M curve is being generated as fuel is loaded into the core. After some fuel elements have been loaded, the count rate existing at that time is taken to be the new initial count rate, C_o. Additional elements are then loaded and the inverse count rate ratio continues to decrease. As a result of changing the initial count rate:

a. criticality will occur with the same number of elements loaded as if there were no change in the initial count rate.

b. criticality will occur earlier (i.e., with fewer elements loaded.)

c. criticality will occur later (i.e., with more elements loaded.)

d. criticality will be completely unpredictable.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

A reactor operates continually at a constant power level. As the reactor operates, the thermal neutron flux:

a. decreases, due to the increase in fission product poisons.

b. decreases, because fuel is being depleted.

c. increases, in order to compensate for fuel depletion.

d. remains the same.

QUESTION: 005 (1.00)

Inelastic scattering can be described as a process whereby a neutron collides with a nucleus and:

a. recoils with a lower kinetic energy, with the nucleus emitting a gamma ray.

b. recoils with the same kinetic energy it had prior to the collision.

c. is absorbed by the nucleus, with the nucleus emitting a gamma ray.

d. recoils with a higher kinetic energy, with the nucleus absorbing a gamma ray.

QUESTION: 006 (1.00)

A reactor is critical at 18.1 inches on a controlling rod. The controlling rod is withdrawn to 18.4 inches. The reactivity inserted is 14.4 cents. What is the differential rod worth?

a. 14.4 cents/inch at 18.25 inches.

b. 48 cents/inch at 18.25 inches.

c. 48 cents/inch at 18.4 inches.

d. 14.4 cents/inch only between 18.1 and 18.4 inches.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

Two critical reactors at low power are identical except that Reactor 1 has a beta fraction of 0.0072 and Reactor 2 has a beta fraction of 0.0060. An equal amount of positive reactivity is inserted into both reactors. Which ONE of the following will be the response of Reactor 2 compared to Reactor 1?

a. The resulting power level will be lower.

b. The resulting power level will be higher.

c. The resulting period will be longer.

d. The resulting period will be shorter.

QUESTION: 008 (1.00)

Which ONE of the following describes the response of the subcritical reactor to equal insertions of positive reactivity as the reactor approaches critical? Each reactivity insertion causes:

a. a SMALLER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

b. a LARGER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

c. a SMALLER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

d. a LARGER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

QUESTION: 009 (1.00)

During the neutron cycle from one generation to the next, several processes occur that may increase or decrease the available number of neutrons. Which ONE of the following factors describes an INCREASE in the number of neutrons during the cycle?

a. Thermal utilization factor.

b. Fast fission factor.

c. Thermal non-leakage probability.

d. Resonance escape probability.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

The effective neutron multiplication factor, K_{eff}, is defined as:

a. absorption/(production + leakage)

b. (production + leakage)/absorption

c. (absorption + leakage)/production

d. production/(absorption + leakage)

QUESTION: 011 (1.00)

For the same constant reactor period, which ONE of the following transients requires the LONGEST time to occur? A power increase of:

a. 5% of rated power - going from 1% to 6% of rated power.

b. 10% of rated power - going from 10% to 20% of rated power.

c. 30% of rated power - going from 20% to 50% of rated power.

d. 50% of rated power - going from 50% to 100% of rated power.

QUESTION: 012 (1.00)

FLIP fuel contain 1.5 weight % erbium. The purpose of the erbium is to:

a. reduce the excess reactivity to compensate for the highly enriched fuel.

b. increase the excess reactivity to compensate for fuel burnup.

c. maintain a constant excess reactivity as fuel burns up.

d. add more absorption peaks in the epithermal energy range to make the fuel temperature coefficient less negative.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

During the minutes following a reactor scram, reactor power decreases on a negative 80 second period, corresponding to the half-life of the longest-lived delayed neutron precursors, which is approximately:

a. 20 seconds.

b. 40 seconds.

c. 55 seconds

d. 80 seconds.

QUESTION: 014 (1.00)

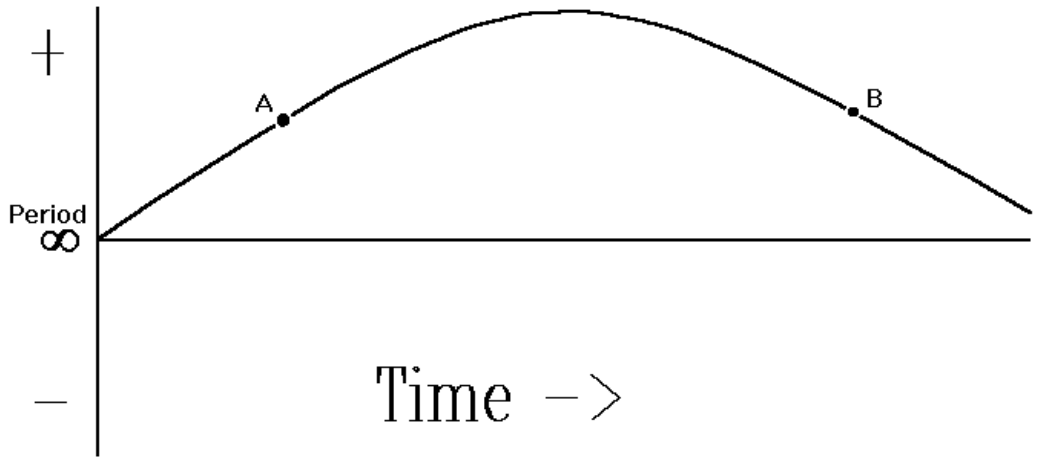
Shown below is a trace of reactor period as a function of time. Between points A and B, reactor power is:

a. continually increasing.

b. increasing, then decreasing.

c. continually decreasing.

d. constant.



(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 015 (1.00)

You enter the control room and observe that the neutron instrumentation indicates a steady neutron level with no rods in motion. Which ONE condition below CANNOT be true?

a. The reactor is critical.

b. The reactor is subcritical.

c. The reactor is supercritical.

d. The neutron source is out of the core.

QUESTION: 016 (1.00)

The reactor is to be pulsed. The reactivity to be inserted is twice the reactivity inserted in a previous pulse. Compared to the previous pulse, the new pulse will have approximately:

a. twice the peak power and four times the energy.

b. four times the peak power and twice the energy.

c. twice the peak power and twice the energy.

d. four times the peak power and four times the energy.

QUESTION: 017 (1.00)

A reactor with an initial population of $1x10^8$ neutrons is operating with a $K_{eff} = 1.001$. Considering only the increase in neutron population, how many neutrons (of the increase) will be prompt when the neutron population changes from the current generation to the next. Assume $\beta = 0.007$.

a. 700.

b. 7,000.

c. 99,300.

d. 100,000.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 018 (1.00)

Which ONE of the following parameter changes will require control rod INSERTION to maintain constant power level following the change?

a. Removal of an experiment containing cadmium.

b. Insertion of a void into the core.

c. Pool water temperature decrease.

d. Buildup of samarium in the core.

QUESTION: 019 (1.00)

Which ONE of the following is the time period during which the MAXIMUM amount of Xenon-135 will be present in the core?

a. 8 to 10 hours after a startup to 100% power.

b. 8 to 10 hours after shutdown from 100% power.

c. 4 to 6 hours after a power decrease from 100% to 50%.

d. 4 to 6 hours after a power increase from 50% to 100%.

QUESTION: 020 (1.00)

The reactor is operating in the automatic mode at 50% power. A problem in the secondary cooling system causes the primary coolant temperature to increase by 5 degrees F. Given that the primary coolant temperature coefficient is 7.0×10^{-5} ρ k/k/deg. F and the differential rod worth of the regulating rod is 8.75×10^{-5} ρk/k/inch, the change in the position of the regulating rod will be:

a. eight (8) inches inserted.

b. eight (8) inches withdrawn.

c. four (4) inches inserted.

d. four (4) inches withdrawn.

(***** END OF CATEGORY A *****)

QUESTION: 001 (1.00)

Which ONE of the following would be classified as an UNUSUAL EVENT in accordance with the Emergency Plan?

a. Sample spill

b. Bomb threat over the telephone

c. Personnel injury with involvement of radiation

d. Severe fuel clad leak approaching MCA size, with pool near empty and ventilation system inoperative

QUESTION: 002 (1.00)

Which ONE statement below describes the basis for the Safety Limit applicable to fuel temperature?

a. Excessive gas pressure may result in loss of fuel cladding integrity

b. High fuel temperature combined with lack of adequate cooling could result in fuel melt

c. Excessive hydrogen produced as a result of the zirconium-water reaction is potentially explosive

d. High fuel temperature could result in clad melt

QUESTION: 003 (1.00)

When a major radioactive spill on the floor occurs (without injury to personnel), the operator must immediately:

a. Perform a radiation survey of the area

b. Flush the floor area with water

c. Attempt to clean up the spill

d. Assure that the reactor is secured

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

In accordance with the Technical Specifications, when is the reactor shutdown?

a. When it is subcritical by at least 0.7% delta k/k

b. When it is subcritical by at least 0.7% delta k/k with the highest worth rod withdrawn

c. When it is subcritical by at least 0.2% delta k/k

d. When it is subcritical by at least 0.2% delta k/k with the highest worth rod withdrawn

QUESTION: 005 (1.00)

In accordance with the Technical Specifications, which ONE situation below is NOT permissible when the reactor is operating?

a. Scram time of a control rod = 1 second

b. A reactivity insertion during pulse operation = 1.4% delta k/k

c. An experiment containing 15 milligrams of explosive material.

d. Reactivity worth of a single experiment = 1.4% delta k/k

QUESTION: 006 (1.00)

Which Safety System channels are required to be operable in all modes of operation?

a. fuel element temperature, reactor power level, manual pushbutton

b. log count rate, fuel element temperature, reactor power level

c. fuel element temperature, pool water level, high voltage monitor

d. manual pushbutton, pool water level, reactor power level

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

In the event of an evacuation, where should personnel be directed to proceed?

a. Emergency Support Center (Reactor Director's office)

b. Mechanical Engineering Central Shop

c. Parking Lot 17

d. Mechanical Engineering Building lobby

QUESTION: 008 (1.00)

The reactor is to be started up and operated in the Steady State mode. Pre-startup activities reveal that the gamma chamber is inoperable. As a result:

a. the reactor may not be operated in any mode.

b. the reactor may only be operated in the Steady State mode.

c. the reactor may be operated in any mode other than the Pulse mode.

d. reactor power must be limited to 100 kW in the Steady State mode.

QUESTION: 009 (1.00)

In accordance with the Technical Specifications, which ONE of the following conditions is allowable during steady-state reactor operation?

a. 1 picoammeter operable.

b. Continuous air monitor inoperable.

c. An experiment containing 2 curies of I-131.

d. A shutdown margin of 0.15% delta k/k.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

Equipment that is tagged with "Do Not Operate" tags and bearing the notation "SRO":

a. may not be operated until the equipment has been repaired and the tag removed.

b. may be operated with the approval of the individual who signed the tag.

c. may not be operated without the approval of a Senior Reactor Operator.

d. may be operated with the approval of an Operator.

QUESTION: 011 (1.00)

Except for periods of maintenance, the facility ventilation system is required to be operating whenever:

a. reactor power exceeds 1 kW.

b. either exhaust stack radiation monitor is inoperable.

c. the thermal column and beamport blower is inoperable.

d. the reactor is operating.

QUESTION: 012 (1.00)

There is indication that the pool may be leaking. The reactor operator should immediately:

a. secure the reactor.

b. attempt to locate and seal the leak.

c. attempt to maintain level by auxiliary fill means.

d. sound the evacuation alarm.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

In accordance with the Technical Specifications, the term "cold critical condition" means that:

a. the reactor is xenon-free and both fuel and bulk water temperatures are below 125 degrees F.

b. the reactor is critical and xenon-free.

c. the reactor is critical and the core does not contain any experiments.

d. the reactor is critical and both fuel and bulk water temperatures are below 125 degrees F.

QUESTION: 014 (1.00)

In accordance with the Technical Specifications, which ONE situation below is NOT permissible when the reactor is operating?

a. A non-secured experiment worth 0.2% delta k/k.

b. One fuel element temperature channel operable.

c. Pool top area radiation monitor inoperable.

d. Core contains one damaged fuel element.

QUESTION: 015 (1.00) QUESTION DELETED

A tour group is to visit the facility. Which ONE statement below is correct?

a. The group is limited to ten visitors plus escort.

b. Each visitor must wear dosimetry.

c. The tour group must be escorted by a Senior Reactor Operator.

d. Visitors will not be exposed to radiation levels > 0.1 mrem/hour.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

A radiation survey of an area reveals a general radiation reading of 1 mrem/hr. There is, however, a small source which results in 10 mrem/hr at one (1) meter. Which ONE of the following defines the posting requirements for the area in accordance with 10CFR20?

a. Caution - Airborne Radioactive Area.

b. Caution - Radiation Area.

c. Caution - High Radiation Area.

d. Caution - Radioactive Materials.

QUESTION: 017 (1.00)

"The reactor power level shall not exceed 1500 kW under any conditions of operation." This is an example of a:

a. safety limit.

b. limiting safety system setting.

c. limiting condition for operation.

d. surveillance requirement.

QUESTION: 018 (1.00)

An Emergency Action Level is:

a. a condition which calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

b. a class of accidents for which predetermined emergency measures should be taken or considered.

c. a procedure that details the implementation actions and methods required to achieve the objectives of the emergency plan.

d. a specific instrument reading or observation which may be used as a threshold for initiating appropriate emergency procedures.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

Match the 10CFR Part 55 requirements listed in Column A for an actively licensed operator with the correct time period from Column B. Column B answers may be used once, more than once, or not at all.

	Column A		Column B
a.	License expiration.	1.	1 year
b.	Medical examination.	2.	2 years
c.	Requalification written examination.	3.	4 years
d.	Requalification operating test.	4.	6 years

QUESTION: 020 (1.00)

Two point sources have the same curie strength. Source A's gammas have an energy of 1 Mev, whereas Source B's gammas have an energy of 2 Mev. You obtain a reading from the same GM tube 10 feet from each source. Concerning the two readings, which ONE of the following statements is correct?

a. The reading from source B is four times that of Source A.

b. The reading from Source B is twice that of Source A.

c. Both readings are the same.

d. The reading from Source B is half that of Source A.

(***** END OF CATEGORY B *****)

QUESTION: 001 (1.00)

The output of the Log Count Rate Channel provides the signal:

a. for the period circuit

b. for the Safety Channels

c. to the Automatic Control Channel

d. for Safety Blade interlocks

QUESTION: 002 (1.00)

When the Stack Air Monitor alarms, which ONE of the following occurs?

a. The reactor scrams

b. The building exhaust fans are turned off

c. Building evacuation alarm sounds after 20 second delay

d. No action occurs

QUESTION: 003 (1.00)

Which ONE of the following will result in a transient rod fire inhibit?

a. Fission chamber count rate < 2 CPS

b. Reactor power = 500 watts

c. Fission chamber in motion

d. Picoammeter on 1000 watt range

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

Which statement is true when operating the Pneumatic Tube in the Manual mode?

a. Two rabbits may be run in the tube, whereas only one rabbit may be run in the Automatic mode

b. The rabbit will automatically return after 20 minutes

c. The rabbit will remain in the core indefinitely

d. The "Emergency Return" will initiate after 30 minutes

QUESTION: 005 (1.00)

How does the ventilation system respond upon receipt of a high radiation alarm from the Stack Air Monitor?

a. The room exhaust fan continues to operate, while the emergency exhaust fan must be manually started

b. The room exhaust fan stops and the emergency exhaust fan automatically starts, taking a suction on the Reactor Laboratory

c. The room exhaust fan stops and the emergency exhaust fan automatically starts, taking a suction on outside air to dilute the stack exhaust

d. The room exhaust fan stops, while the emergency exhaust fan must be manually started

QUESTION: 006 (1.00)

Which ONE of the following conditions will NOT result in a reactor scram (either relay or electronic)?

a. Pool water level 18 feet above top of core

b. Loss of high voltage supply power to gamma power level detector

c. Fuel temperature = 400 deg Fahrenheit

d. Power = 125%

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

When the Pool Top area radiation monitor reaches the HIGH setpoint, which ONE of following occurs (assuming no operator action)?

a. An evacuation alarm sounds after 20 seconds.

b. The reactor scrams.

c. The building exhaust fan is turned off.

d. The emergency exhaust fan is turned on.

QUESTION: 008 (1.00)

Primary system flow rate is measured using an orifice plate installed:

a. at the suction of the primary cooling pump.

b. at the outlet of the heat exchanger.

c. at the discharge of the primary cooling pump.

d. at the inlet to the heat exchanger.

QUESTION: 009 (1.00)

Which ONE of the following conditions will result in an annunciator alarm?

a. Core inlet temperature at 128 degrees F.

b. Reactor period = 12 seconds.

c. Beam port shutter open.

d. Emergency exhaust fan on.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

When 18 pounds of air pressure is applied to the heat exchanger control valve actuator, the valve:

a. moves to full open, providing full flow to the heat exchanger.

b. moves to full open, with flow bypassing the heat exchanger.

c. moves to full closed, providing full flow to the heat exchanger.

d. moves to full closed, with flow bypassing the heat exchanger.

QUESTION: 011 (1.00)

Which ONE of the following statements is true regarding the Stack Air Monitor (SAM) and the Continuous Air Monitor (CAM)?

a. The SAM measures only gaseous activity, while the CAM measures only particulate activity.

b. The SAM measures both gaseous and particulate activity, while the CAM only measures gaseous activity.

c. The SAM measures only gaseous activity, while the CAM measures both gaseous and particulate activity.

d. The SAM and the CAM each measure both gaseous and particulate activity.

QUESTION: 012 (1.00)

When the "Experimental Facility Radiation Level High" annunciator alarms:

a. an evacuation alarm sounds after 20 seconds.

b. the reactor scrams.

c. the emergency exhaust fan is started.

d. no automatic actions occur.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

The Safety Channels (picoammeters):

a. supply a period signal for use in the Automatic mode.

b. provide a 1 kW inhibit for the pulse or square wave modes.

c. provide a scram at 115% power.

d. are disconnected during pulsing operation.

QUESTION: 014 (1.00) QUESTION DELETED

A condition arises which results in an electronic scram but not a relay scram. In response, the safety blades drop:

a. the regulating blade drops, and the transient rod drops.

b. the regulating blade drives in, and the transient rod drops.

c. the regulating blade remains as is, and the transient rod drops.

d. the regulating blade drives in, and the transient rod remains as is.

QUESTION: 015 (1.00)

With reference to the cooling tower control valve:

a. when sump tank temperature drops to about 45 degrees F, the valve opens fully to allow water to be pumped to the cooling tower.

b. when air pressure to the valve actuator is lost, the valve moves to the fully open position.

c. the valve is either fully open or fully closed depending on sump tank temperature.

d. the valve may be partially opened by varying the air pressure to the controller.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

The reactor is in the Automatic mode at a power level of 500 kW, with the transient rod selected as the controlled element. The neutron detector from which the control system receives its input suddenly drops to 100 kW as a result of an electronics problem. As a result:

a. the control system inserts the transient rod to reduce power to try to match the power of the failed detector.

b. the control system drops out of the Automatic mode into the steady-state manual mode.

c. the control system withdraws the transient rod to increase power to try to meet the demand of the power schedule.

d. the reactor scrams.

QUESTION: 017 (1.00)

For a safety blade, the "magnet engaged" light is illuminated when:

a. current is provided to the electromagnet.

b. a limit switch within the scram magnet closes.

c. the blade "out" limit light is illuminated.

d. all scrams are reset.

QUESTION: 018 (1.00)

The fission counter is moveable so that it can be withdrawn from high neutron flux. While the counter is moving (either in or out):

a. the reactor cannot be placed in the Automatic Control mode.

b. safety blades cannot be withdrawn.

c. safety blades cannot be inserted.

d. period indication will change.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 019 (1.00)

When the Master Switch (Key Switch) is in the TEST position:

a. current is not available to the drive magnets.

b. safety blades can be withdrawn.

c. scrams cannot be reset.

d. safety blade drives will run in if a relay scram is present.

QUESTION: 020 (1.00)

Which ONE of the following combinations of Mode switch position, power, and transient rod drive positions permits firing of the transient rod?

a. Manual mode, 300 watts, transient rod at 12.34 inches.

b. Pulse mode, 300 watts, transient rod at 12.34 inches.

c. Manual mode, 200 kilowatts, transient rod at 11.00 inches.

d. Square Wave mode, 200 kilowatts, transient rod at 11.00 inches.

(***** END OF CATEGORY C *****)
(***** END OF EXAMINATION *****)

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 001 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.
When k_{eff} = 0.955, ρ = -0.047 delta k/k; 4.9% delta k/k = + 0.049 delta k/k
- 0.047 + 0.049 delta k/k = + 0.002 delta k/k, therefore reactor is supercritical.

QUESTION: 002 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics I.

QUESTION: 003 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics IV, Critical Experiment.

QUESTION: 004 (1.00)
C or D.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.

QUESTION: 005 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics I.

QUESTION: 006 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics IV, Control Rod Calibration.
ρρ = 14.4 cents; ρx = 18.4 - 18.1 = 0.3 inches; ρρ/ρx = 48 cents/inch at the midpoint (18.25 inches).

QUESTION: 007 (1.00)
D.
REFERENCE:
Equation Sheet. $\rho = (\ell^*/\rho) + [(\beta-\rho)/\rho_{eff}\rho]$

QUESTION: 008 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics IV, Critical Experiment.

QUESTION: 009 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics I.

QUESTION: 010 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics I.

ANSWER: 011 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Math and Physics.
$P = P_0 e^{(t/\rho)}$; The time will be the longest for the largest ratio of P to P_o = 6/1.

ANSWER: 012 (1.00)
A or C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics III.

ANSWER: 013 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.

ANSWER: 014 (1.00)
A.
REFERENCE:
Since the period is always positive, power must be increasing.

ANSWER: 015 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.

ANSWER: 016 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics IV, Reactor Pulsing.

ANSWER: 017 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.
The increase = $1x10^8x1.001$ = 100,000 neutrons. Delayed neutrons = 0.007x100,000 = 700. Prompt = 99,300.

ANSWER: 018 (1.00)
A.
REFERENCE:
Insertion of a control rod inserts negative reactivity to balance the positive reactivity added when removing a neutron absorber. All other answers add negative reactivity.

ANSWER: 019 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics I.

ANSWER: 020 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Physics II.
Since the coolant temperature increased, positive reactivity was added. Therefore, the rod must add negative reactivity, i.e. inserted. (5 deg. F)x($7x10^{-5}$ delta k/k/deg. F) / ($8.75x10^{-5}$ delta k/k/inch) = 4 inches.

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

ANSWER: 001 (1.00)
B.
REFERENCE:
UWNR Procedure 006

ANSWER: 002 (1.00)
A.
REFERENCE:
UWNR Technical Specifications, Section 2.1.

ANSWER: 003 (1.00)
D.
REFERENCE:
UWNR Procedure 150

ANSWER: 004 (1.00)
A.
REFERENCE:
UWNR Technical Specifications, Section 1.1

ANSWER: 005 (1.00)
D.
REFERENCE:
UWNR Technical Specifications, Section 3.6.b

ANSWER: 006 (1.00)
C.
REFERENCE:
UWNR Technical Specifications, Section 3.3.3

ANSWER: 007 (1.00)
D.
REFERENCE:
UWNR Procedure 006, Page 6.

ANSWER: 008 (1.00)
C.
REFERENCE:
UWNR Procedure 001, Page 2.

ANSWER: 009 (1.00)
B.
REFERENCE:
UWNR Technical Specifications, Section 3.4

ANSWER: 010 (1.00)
C.
REFERENCE:
UWNR Procedure 001, Page 3.

ANSWER: 011 (1.00)
D.
REFERENCE:
UWNR Technical Specifications, Section 3.5.

ANSWER: 012 (1.00)
A.
REFERENCE:
UWNR Procedure 151, Page 2.

ANSWER: 013 (1.00)
D.
REFERENCE:
UWNR Technical Specifications, Section 1.4.

ANSWER: 014 (1.00)
D.
REFERENCE:
UWNR Technical Specifications, Section 3.7.

ANSWER: 015 (1.00) QUESTION DELETED
D.
REFERENCE:
UWNR Procedure 001, Page 4.

ANSWER: 016 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Health Physics I & II.
10 mrem/hr. at 100 cm. -> 111.1 mrem/hr. at 30 cm.

ANSWER: 017 (1.00)
A.
REFERENCE:
UWNR Technical Specifications, Section 2.1.

ANSWER: 018 (1.00)
D.
REFERENCE:
UWNR Procedure 006.

ANSWER: 019 (1.00)
A, 4; B, 2; C, 2; D, 1 or A,4; B,2; C,1; D,1.
REFERENCE:
10 CFR Part 55.

ANSWER: 020 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Health Physics III.

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation I and II.

ANSWER: 002 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation VI.

ANSWER: 003 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation V.

ANSWER: 004 (1.00)
C.
REFERENCE:
UWNR Procedure 132

ANSWER: 005 (1.00)
A.
REFERENCE:
UWNR SAR, Page 3-32

ANSWER: 006 (1.00)
C.
REFERENCE:
UWNR Technical Specifications, Section 3.3.3

ANSWER: 007 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation VI.

ANSWER: 008 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Reactor Water Systems IV.

ANSWER: 009 (1.00)
A.
REFERENCE:
UWNR SAR, Section 2.5.8.

ANSWER: 010 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Reactor Water Systems IV.

ANSWER: 011 (1.00)
D.
REFERENCE:
UWNR Operator training Manual, Controls and Instrumentation VI.

ANSWER: 012 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation VI.

ANSWER: 013 (1.00)
D.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation V.

ANSWER: 014 (1.00) QUESTION DELETED
C.
REFERENCE:
UWNR Sample Exam Questions, Category C, No. 7.

ANSWER: 015 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Reactor Water Systems IV.

ANSWER: 016 (1.00)
C.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation III.

ANSWER: 017 (1.00)
B.
REFERENCE:
UWNR SAR, Section 2.2.1.

ANSWER: 018 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation I & II.

ANSWER: 019 (1.00)
A.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation V.

ANSWER: 020 (1.00)
B.
REFERENCE:
UWNR Operator Training Manual, Controls and Instrumentation V.

A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001	a	b	c	d _____
002	a	b	c	d _____
003	a	b	c	d _____
004	a	b	c	d _____
005	a	b	c	d _____
006	a	b	c	d _____
007	a	b	c	d _____
008	a	b	c	d _____
009	a	b	c	d _____
010	a	b	c	d _____
011	a	b	c	d _____
012	a	b	c	d _____
013	a	b	c	d _____
014	a	b	c	d _____
015	a	b	c	d _____
016	a	b	c	d _____
017	a	b	c	d _____
018	a	b	c	d _____
019	a	b	c	d _____
020	a	b	c	d _____

(***** END OF CATEGORY A *****)

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001 a b c d _____

002 a b c d _____

003 a b c d _____

004 a b c d _____

005 a b c d _____

006 a b c d _____

007 a b c d _____

008 a b c d _____

009 a b c d _____

010 a b c d _____

011 a b c d _____

012 a b c d _____

013 a b c d _____

014 a b c d _____

015 a b c d _____

016 a b c d _____

017 a b c d _____

018 a b c d _____

019 a_____b_____ c_____ d _____

020 a b c d _____

(***** END OF CATEGORY B *****)

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001	a	b	c	d _____
002	a	b	c	d _____
003	a	b	c	d _____
004	a	b	c	d _____
005	a	b	c	d _____
006	a	b	c	d_____
007	a	b	c	d _____
008	a	b	c	d _____
009	a	b	c	d _____
010	a	b	c	d _____
011	a	b	c	d _____
012	a	b	c	d _____
013	a	b	c	d _____
014	a	b	c	d _____
015	a	b	c	d _____
016	a	b	c	d _____
017	a	b	c	d _____
018	a	b	c	d _____
019	a	b	c	d _____
020	a	b	c	d _____

(***** END OF CATEGORY C *****)

EQUATION SHEET

$Q = m\ c_p\ \rho T$

$CR_1\ (1\text{-}Keff)_1 = CR_2\ (1\text{-}Keff)_2$

$SUR = 26.06/\rho$

$P = P_0\ 10^{SUR(t)}$

$P = P_0\ e^{(t/\rho)}$

$\rho = (\ell^*/\rho) + [(\beta\text{-}\rho)/\rho_{eff}\rho]$

$\rho_{eff} = 0.1\ seconds^{-1}$

$Doserate_1\ x\ D_1^2 = Doserate_2\ x\ D_2^2$

$DR = DR_o e^{-\rho t}$

$DR = 6CiE/D^2$

$\rho = (Keff\text{-}1)/Keff$

1 Curie = $3.7x10^{10}$ dps

1 gallon water = 8.34 pounds

1 Btu = 778 ft-lbf

°F = 9/5°C + 32

1 Mw = $3.41x10^6$ BTU/hr

°C = 5/9 (°F - 32)